

sons in the north temperate and arctic regions continued from six months before to six months after corresponding cold winters in the extreme southern temperate region. The latitudes visited by vessels that round Cape Horn are usually a little less than $S. 60^\circ$, corresponding, therefore, to Behring Sea, southern Alaska, Cape Farewell, the Orkney Islands, Christiania and St. Petersburg, and, in fact, are very little farther south of the equator than the routes followed by the steamers from Glasgow to North America are north of the equator. The fact that there is so much more ice in these southern latitudes than in the corresponding northern latitudes must be attributed largely to the winds of the antarctic regions and the distribution of ocean and land. Any special increase or diminution in the ice, either arctic or antarctic, must result from a change in the winds; it may be in their direction, or force, or temperature, or moisture. Whatever the cause of that change in the wind, it must affect a large portion of the Southern Hemisphere appreciably. If, however, the ultimate cause consist, in some phenomenon peculiar to the equatorial regions, it may affect both the arctic and antarctic simultaneously. In fact such conditions may prevail over the whole north temperate zone as to influence the circulation of the atmosphere in the south temperate and antarctic regions, and this influence may either be direct and simultaneous, or indirect and only apparent after many months.

A consideration of the mechanics of the atmosphere justifies the collection and intercomparison of even the popular news items in the daily press describing special and abnormal phenomena in distant places. As far back as 1780 Dr. E. A. Holyoke, of Salem (Memoirs Am. Acad., Vol. II), made a comparison between the weather on opposite sides of the Atlantic Ocean, hoping to discover some simple reason for the contrasts between the two regions. We, on the other hand, are now tempted to compare together the weather of the arctic and antarctic circles. There have opportunely come to hand a few reports from vessels off the coasts of Alaska and Patagonia. A letter published in the San Francisco Chronicle of October 8 from the fleet of whalers in the Behring Sea, dated August 14, 1895, states that—

On sailing northward in July from Unalaska ice was met within about 100 miles, and was always present until reaching Port Clarence, and that it had never before been seen so near to Unalaska by any one. From Port Clarence to Point Barrow the vessel's progress was exceedingly slow on account of the drifting ice, scarcely a mile having been made in the first fifteen days of August. The northeast wind that usually keeps this ice off shore has been wanting.

Dr. Sheldon Jackson, agent for the Bureau of Education, reports a similar experience by the revenue cutter *Bear* while north of Behring Straits. The southern edge of the arctic ice pack had remained so far south as to prevent any passage north of Icy Cape from July 19 to August 22. Parties from Point Barrow who had traveled down the coast for their mail, report that the past winter, 1894-95, had not been very cold, the lowest temperature being -30° . (See the National Geographic Magazine for January, 1896.)

We are not to infer from the above that there has been unusual cold or an unusual quantity or thickness of ice, but simply that the wind failed to counteract the ocean currents that drifted the ice on shore.

From the Los Angeles Express of Nov. 26, 1895, we learn that the British ship *Anglesey* arriving at San Francisco on that date, like every other vessel that has arrived at that city after rounding Cape Horn during the summer and autumn of 1895, reports an unusual quantity of ice in that region, and corresponding unusual storms and freezing weather and snow. Usually a northwest wind drives the antarctic ice southward, just as a southwest wind drives the arctic ice northward.

We may infer that there has, during the past July and Au-

gust, been a diminished tendency to northwest winds near the antarctic circle, while, at the same time, there was a diminished tendency to northeast winds in northern Alaska.

As the winds in northern Alaska are associated with the low pressure area in Behring Sea the abnormal wind conditions indicate an abnormal condition of that low area, and, in fact, it was probably at this time almost entirely obliterated by an unusual northward extension of the great high area of the North Pacific, which area also brought cold weather to the Pacific Coast States.

As the westerly winds at Cape Horn represent a general circulation around the low area of the Antarctic Continent, and as the winds at the Cape are usually northwesterly, blowing outward from the high pressure area of the South Pacific, we must infer that the absence of northwest and the presence of southwest winds in this region implies a diminished activity of the high area in the South Pacific.

Now, this tendency to an increased activity of the northern area is but an exaggeration of what ordinarily takes place in the changes from January to July, or winter to summer, in the Northern Hemisphere; similarly, the tendency to a diminished activity of the southern high area is an exaggeration of what takes place in that region in the transition from July to January (winter to summer) in the Southern Hemisphere. Both these changes are, therefore, in harmony with those variations in the general circulation that depend upon the interactions of oceans and continents. The change in the North Pacific area is that which would be produced by an increased contrast of land and water in the northern summer, and the change in the South Pacific high area is that due to a diminished contrast between land and water in the southern winter season. Therefore, in the north, or summer, the continental air has been warmer than the oceanic air, but in the south, or its winter, the continental has been cooler than the oceanic air in the region of high pressure. Both of these changes may be plausibly traced back to some one single cause, such as an increased dryness of the atmosphere, which makes hotter summers and colder winters. Although the latter suggestion may not present the true cause in this specific case, yet it often may be applicable to similar cases, and it seems to enforce the general principle that widespread and persistent seasonal variations of climate may result from a very slight general disturbance in the quantity of moisture in the air, or an excess of ascending or descending movements in the atmosphere.

THE LOCAL STORM OF SEPTEMBER 8 IN KANSAS.

The map of Sunday, September 8, at 8 p. m., shows a general movement of the wind from south and southeast over Texas, Missouri, Illinois, Indiana, and thence northward to North Dakota. This movement may be considered in either of its aspects, viz, either as a flow of air towards a special low pressure in Alberta, or as a flow toward the high, warm tableland constituting the eastern slope of the Rocky Mountains. A barometric pressure of 29.7 or 29.8 prevailed over the greater part of the Plateau Region, and a temperature of 80° or 90° prevailed from Nebraska south and east over the Gulf States, with generally clear weather. As there was no strongly developed low pressure, therefore the local showers that occurred, with thunder and lightning, during the 8th and 9th, must be considered, not as an essential part of a system of cyclonic circulations, but as local incidents due more particularly to special local influences. The locations of such storms, with reference to the center of low pressure, has but little significance as compared with their locations relative to the winds and local topography. However, an exception must be made in respect to the storm that occurred on the 8th, a. m., in Morris and Lyon counties, Kans., and moved thence southeastward to the southeast corner of the State into

Missouri, which was too large to be called a local storm; in fact, it seems to present phenomena characteristic of the southern end of all long troughs of low pressure. In this case the trough may be considered as extending, on the 8th, p. m., from central Kansas to southern Alberta. On the west side the cold, drier air over the Plateau Region was undoubtedly descending and pushing eastward, but had not yet made itself felt as a general westerly wind, except at Pueblo, Santa Fe, and Amarillo. In this region, which lies a little southwest of, and higher than, central Kansas, such winds prevailed, as would, by descending to the lower level of that State, produce the rise of 20° in temperature that was reported from Wichita and Dodge City, with corresponding falls in the barometer. This descending stream of air, having once reached the surface of the ground, and pushing eastward, must have presented the usual well-known appearance of an onward rolling or rushing wall of air, lifting up the lighter air in front, topped along its whole extent by a long and comparatively narrow belt of what might, to a distant observer, appear as one cloud, but which, on closer inspection, is seen to be a series of isolated whirls and hailstorms, horizontal rolls and straight-line movements, all in close juxtaposition and presenting a scene of violent, turbulent motion. At first the front was a small region, perhaps 5 miles long in the southeastern portion of Morris County, and northwestern portion of Lyon County, and therefore about 100 miles west-southwest of Kansas City, and was but the front of an entering wedge for the large mass of air to follow behind. About noon of Sunday, the 8th, the front was not only moving eastward as a whole, but also lengthening by its steady growth toward the southeast and the northwest, and by 8 p. m. had passed beyond Concordia on the north and Springfield (Mo.) on the east, and was near Kansas City. A description of the effects of the storm in southeastern Kansas, as compiled from the WEATHER REVIEW, for that State, would be about as follows:

On the east side of a line from Lyon County toward the southwest corner of Kansas the corn was blown down from the northeast and on the west side from the northwest to southeast, showing the path to have been about 25 miles wide; inside of this was an area of destructive hail about 15 miles wide, while beyond it was the area of excessive rainfall, about 60 miles wide. The hail lay in broad streaks or paths; all hailstorms [streaks?] on the east side of the center traveled [trended?] from northeast to southwest and on the west side, from northwest to southeast. In many of the hail streaks the leaves, fruit, and bark were stripped from the trees, and the next morning the groves were left bare, as in January; 4, 8, and 10 inches of water were measured in standard rain gauges, and a box standing isolated near the center of the storm path, 14 inches deep, was full of water on the morning of the 9th. This storm was succeeded by hot, dry weather. The electrical display was quite remarkable, and was reported by observers in Clay County, 120 miles west of Kansas City, and Reno County, 100 miles southwest of Morris and Lyon counties.

THE EARTHQUAKE OF SEPTEMBER 1.

This earthquake shook the whole of the region between Virginia and Maine, but did not extend west of the central portions of these Atlantic States. The time and character of the shocks are briefly given in the following summary:

Virginia.—Falls Church, lasted several seconds.

District of Columbia.—Washington, 6 hr. 8 min. 39 sec., a. m., by the Weather Bureau seismograph.

Maryland.—Westminster, 6.05; distinct trembling of the house for a few seconds.

Delaware.—Wilmington, slight tremor; duration one second, at 6.10.

New Jersey.—Perth Amboy, 6.08; lasted from three to ten seconds. Beverly, 6.10; lasted a full minute. Plainfield, 6.01; lasted ten seconds. Englewood, 6.10. Rancocas, 6.08. New Brunswick, 6.07. Moorestown, Newark, Clinton, Bridgeton, Oceanic, Elizabeth, Bayonne, Alaire, Somerville, Burlington, Palmyra, Freehold, and Toms River, recorded without

details. Red Bank, not noticed by people out of doors, but distinctly felt by people inside of houses. Belmar, 6.08; accurately observed by Mr. Edward Brown. Asbury Park, loose plaster fell from the ceilings. Sandy Hook, in the Marine Observatory the tower shook slightly for about eight seconds. Jersey City, 6.10, at the Erie Railroad depot. Englewood, 6.10 exactly; oscillations lasted from eight to ten seconds. Port Jervis, 6.08. High Bridge, perceptible shock. Elizabeth, 6.15. Plainfield, 6.00. Trenton, between 5.00 and 6.00. New Brunswick, 5.50. Morristown, 5.45. Orange, not noticeable.

Pennsylvania.—Easton, church bell rang shortly after 6 a. m. Philadelphia, shortly after 6 a. m.; buildings swayed perceptibly. Allentown and Phoenixville, buildings swayed and many awakened from sleep.

New York.—New York, not so severe as that of August 10, 1884, August 31, 1886, or March 8, 1893; Weather Bureau office, vibrations for ten seconds at 6h. 11m. a. m. Staten Island, a strong, single shock, lasting ten seconds, occurred at 6 hr. 10 min. a. m. Governors Island, the ordinance sergeant was awakened by the shock. New York Harbor, the ferry boats rocked as in heavy weather, and a rumbling sound occurred as if the boats were scraping on the bottom. Long Island and Brooklyn, three distinct shocks; the earthquake generally travelled eastward, and was felt most decidedly on the south side of the island. Rockaway Beach, the sand continued in motion about two minutes, and the surf suddenly subsided. Bath Beach, two persons are said to have been thrown out of bed. Jamaica and Newtown, 6.05. Flushing, about 5.45. Northport and Mount Vernon, about 6.00. Yonkers, a little after 6.00. White Plains, 6.15. Sing Sing and Tarrytown, slight shock. Newburg, three gentle shocks felt at Washington Heights. Bedford, 6.06.

Connecticut.—Greenfield Hill (from the Bulletin of the New England Weather Service):

Uncorrected time, 6.08 a. m.; duration not over ten seconds; direction of movement nearly southwest to northeast. Only a few people were out at that hour, and not many of those few noticed the shock. In houses it was felt generally, and nearly all report having received the impression of the wave motion. Being in bed at the time, I felt the rocking motion; the jarring motion was felt faintly. A resident of the valley, about half a mile away from here, said his house was badly shaken. The shock passed away with a roaring sound similar to that sent back from water when a heavy gun is fired over it.

Connecticut.—Westport, houses swayed.

With reference to the accuracy of the determinations of the exact time of the earthquake shock at Washington, Mr. D. T. Maring, who (in the absence of Professor Marvin at Atlanta) was in charge of the Instrument Room at that time, writes as follows:

The time of earthquake shocks is recorded as follows: On a register cylinder, making a revolution every six hours, an ordinary office "regulator" clock marks off 5-minute intervals by closing a circuit through a magnet of the register about four seconds after the ending of each fifth minute of the hour. Whenever the needle of the seismograph is disturbed, it also records by closing a circuit through the same magnet that makes the clock record. Careful interpolation between the clock and seismograph records will, therefore, give the time by the "regulator" clock at which the needle of the seismograph was disturbed.

The accuracy of the interpolation between the clock and seismograph records will depend upon the definiteness and fineness of the lines made by the recording pen. In this particular instance the case is somewhat complicated because the seismograph record followed so closely after the clock record that the two are united into one wide mark, excepting at their points. The marks representing the clock records cover a space equivalent to about forty seconds of time, the variation in width not being greater than five seconds. The combined width of the two marks, as recorded in this instance, is equivalent to about sixty-five seconds of time on the sheet, while the distance between their points is equivalent to about twenty-five seconds. The time of the vibration of the needle of the seismograph here recorded appears, therefore, to have been made within five seconds of twenty-five seconds after the clock record was made, or at ten minutes twenty-nine seconds after 6 o'clock a. m., of September 1, 1895.